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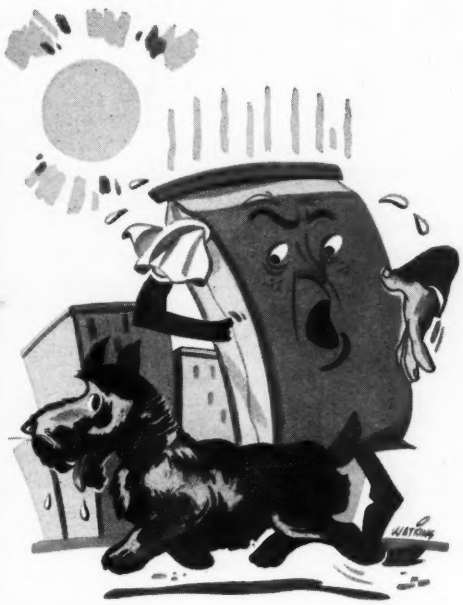

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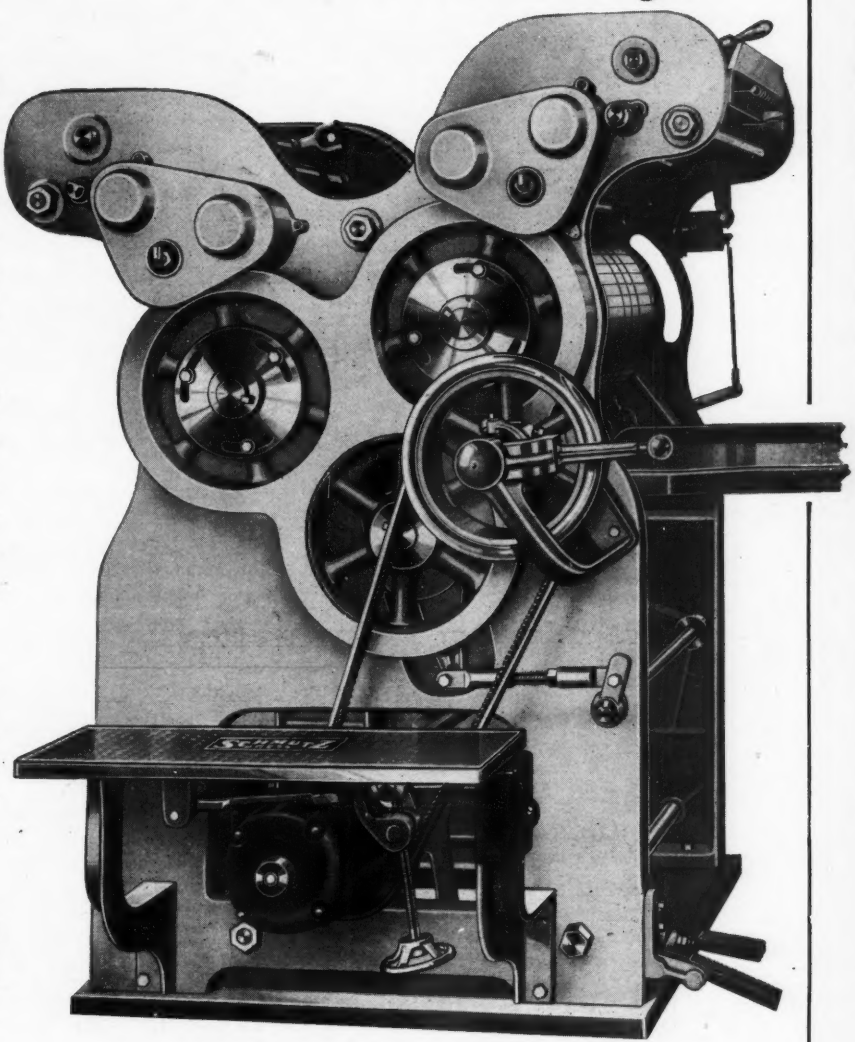

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NITROGEN SOLUTION...3	66.8	16.6	16.6	11.69	25.34	37.0

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The American FERTILIZER

Vol. 108 MAY 15, 1948 No. 10

Nature and Problems of Fertilizing in Modern Times*

By PROFESSOR D. K. SCHARRER

Director, Institute of Agricultural Chemistry, University of Giessen, Germany

Part I. Humus and Calcium

WITH the founding of our modern agricultural chemistry in 1840 through the publication of his book (*1*) "Organic Chemistry in Its Applications to Agriculture and Physiology," Justus v. Liebig was at the same time actually the creator of our modern science of fertilization (*2*).

He showed that the carbon nutrition of cultivated plants from the supply of carbon dioxide in the atmosphere is disputable, and proved that Thaer's humus theory is not tenable. He further determined the importance of inorganic substances to plant life, and recognized their supply as indispensable to the nutrition of plants.

Later, in a classic manner, Adolph Mayer (*3*), who recently died in Heidelberg when 100 years of age, described the nature of modern fertilization as supplying materials to lands used for agriculture in order to increase soil fertility and crop yields. It does not suffice merely to supply plants with nutrients; correct fertilization must also take care of the maintenance of soil fertility.

He who constantly bears in mind these two tasks of modern fertilization, will recognize that only a combined application of natural and commercial fertilizers may in the long run be considered as constituting a correct fertilizer program, that is to say, that natural fertilizer materials furnish conditions for the maintenance of soil fertility, whereas commercial fertilizers furnish the nutrients in adequate amounts. Inasmuch as under the conditions of practical crop production their nutrition substrate is always in the soil, plants are accordingly always fertilized through the medium of soil, and never directly. In all plans for the supplying of nutrients to plants under practical conditions, it is fundamental to study how the fertilizer material in question reacts upon the soil and, in turn, is acted upon by the soil. The fact that these conversions of fertilizer materials sometimes play a major role, and become essential prerequisites to their effectiveness, is probably most vividly demonstrated by calcium-nitrogen compounds. We may apply one of these compounds to the soil, for instance, as calcium cyanamid, a combination which the plant cannot utilize and which, in fact, could prove injurious. First of all, normal soils within a relatively short time will effect changes, probably mainly through microbiological action, as shown by the work of K. Schmalfuss (*4*), and the calcium cyanamid is converted via free cyanamid and urea into ammonium carbonate. Thus, starting with a material that is poisonous to plants, we end up with a suitable nutrient in the form of ammoniate or nitrate compounds.

* Translated from *Chemiker-Zeitung*, Vol. 68, No. 5, pp. 75–93—(May, 1944) and made available by The Alien Property Custodian. Translators—J. F. Wischhusen, Director, Manganese Research and Development Foundation and Vincent Sauchelli, Director, Agricultural Research, The Davison Chemical Corporation.

Humus Substances

Insofar as it concerns scientific fertilization, we now have fundamentally new concepts which are based on investigations of humus substances. In the past, the production and use of these fertilizer materials were concerned primarily with their nutrient content. Today, we regard it as our main problem to enrich them with as high a concentration of humic matter as possible.

Scheffer (*5*) proposed a classification of humus substances, which has proved very practical for further research work. He divides them as follows:

1. Nutrient humus, which is easily broken down, and principally serves microorganisms as a source of carbon. We can ascertain this, therefore, by measuring soil respiration.
2. Long-life humus, more appropriately designated by Gieseke (*6*) as maintenance-humus, which has proven very useful for further research because it represents the humus capital of soils. This is due to the fact that it is slowly converted and also because, through its organic absorption complex, it is of importance in base exchange reactions.

Methods have been proposed to separate analytically the two forms of humus mentioned, and more particularly to classify their qualities, especially those of the long-life humus. Sulphuric acid (80 per cent) is a means of separating long-life from nutrient humus. Acetylbromide makes it possible to separate the remaining insoluble matter, the real humin matter, from its initial steps, and by such means it is possible to follow the decomposition processes of natural manuring materials in an organized, systematic manner.

Springer (*7*) recently succeeded with the use of combined solutions of acetylbromide and glacial acetic acid to effect a further separation of the permanent humus into single fractions. This research worker, as well as Hock (*8*), Fromel (*9*), Simon (*10*), Scheffer and his co-worker (*11*) determined more particularly the various forms of humic matters through extractions by means of sodium hydroxide, sodium carbonate, sodium fluoride and sodium oxalate. In this research, they employed various oxydative methods, and the method of chromatographic adsorption analysis. Simon found that only sodium fluoride and sodium oxalate were really capable of dissolving the true humic substances, whereas the humus derivatives and the decomposition products (intermediates in the formation of humus) dissolved only to a slight extent; so that substances not soluble in acetylbromide were soluble in the neutral salts mentioned. Nature and Problems of Fertilizing, etc. cont.

We know today that soil humic matter is derived essentially from organic substances of vegetable or animal residues in such a manner that lignins and proteins go through a process of decay; they are thoroughly decomposed, mainly through microbial metabolism. Then, through reciprocal transformations these products of reduction form entirely new bodies. Scheffer (*5*) correctly emphasizes that metabolic reactions build entirely new matter from end-products in such black-colored soil matter as has resulted from co-reactions of biological forces. This same matter becomes changed to such a degree that its power of resistance to microbial reduction henceforth is materially increased. One could almost have predicted in advance the probability that several different types of humic matter were to be found in nature.

Gray and Brown Humic Acids

Springer (*12*) succeeded in establishing the presence of gray humic acids together with the brown. The former are never found alone, being always in mixtures of brown humic acids in brown and black soils; their share of the humus substances of black soils amounts to about 25 to 30 per cent, whereas the rest consists of brown humic acids, which are preponderantly present in podzol soils.

The gray humic acids differ from brown humic acids not only through a different shade of color, but also through a higher nitrogen content, higher electrolytic sensitiveness, increased fixation of clays and better sorption materials, as well as through a different internal structure, basicity, molecular weight and sorption capacity. The gray humic acids are therefore much more saturated with bases, especially calcium, than the brown humic acids, and therefore, because of the above mentioned higher electrolytic sensitiveness, do not form the agriculturally dangerous humus salt-spring which is generally described by the expression "acid humus." The injurious effects of protective colloids associated with brown humic acids, with all their destructive consequences to soil fertility (leaching of soil colloids and consequent degradation and podzolization), are therefore as good as excluded from gray humic acids.

Another important differentiation between them is that the light absorption values of gray humic acids are essentially higher than those of the brown humic acids. It has been shown that such gray humic acids as occur

(the best forms of persistent humus) are found only in our humid and semi-humid climates. They occur when lignins and proteins are decomposed in the presence of calcium ions and inorganic sorption complexes (*5*).

These short references to the most important results of modern humus research are of fundamental importance to our present attitude towards organic fertilizer materials, and of great practical and theoretical value, because from them can develop a wealth of new research projects. All those measures which help to enrich soils with persistent humus deserve the highest consideration for the maintenance and improvement of soil fertility.

In order to stabilize the persistent form of humus, it is, however, necessary to bind it to the inorganic sorption complexes of the soil with the help of calcium ions. It is further essential that the ideal soil type, namely the black earth, should contain about 70 to 80 per cent maintenance humus, and 20 to 30 per cent nutrient humus in its organic matter, whereas the best kinds of stable manures contain only 30 to 40 per cent of the persistent type of humus (*5*). This points out that in the future our main concern in the production of organic fertilizer materials must be with the increase of maintenance humus, which probably can be done through more and better composting. Despite the importance of nutrient humus as a source of food for heterotropic soil micro-organisms, and as generator of carbon dioxide so necessary for the loosening of heavy soils and the solution of soil nutrients, nevertheless, in the interest of soil fertility improvement, our first concern should be with an increase in maintenance humus because this represents a prerequisite to a mellow soil, which Seckera (*13*) aptly described as the maintenance of a crumb structure.

The Need for the Best Humus

Inasmuch as the humus condition of German soils is unsatisfactory in respect to quantity, as well as quality, one of the most important tasks in the maintenance of soil fertility by means of fertilization, is to discover how to enrich our soils to the highest degree with the most valuable organic materials. (This condition is common to most podzolized soils even in the U. S. A.—*Editors*)

The pattern for this must naturally be the humic material of black earth. The aim indicated can only be reached if the soils can be enriched with long-life humus of the gray, humic acids kind. It was shown especially by Springer (*14*), in an eleven-year continuous experiment at Nederling near Munich, that it is possible to obtain a certain humus increase on condition that the soil contain sufficient calcium, is not too light, and the quantity of leaching does not exceed a certain upper limit. Furthermore, it is indeed essential that the enrichment of soils with humus take place only in such quantity as will incorporate permanent humus from organic manuring. Compared with this, stubble and root residues are merely sources of nutrient humus, and, therefore, in themselves do not contribute to a humus enrichment of soils.

These findings lead clearly to the conclusion that, in the future, the putrefaction of stable manure must be effected with a view to obtaining the highest degree of disintegration; in other words, our purpose should be to try to produce a larger amount of the permanent and less of the nutrient type of humus than heretofore.

Peat, as compared with straw, has already been shown to have a certain amount of long-life humus, so that Springer (*16*) proposes to substitute peat meal for straw as animal bedding, because a number of trials with a mixture of peat and straw have already furnished advantageous results. Giesecke and Michaels (*17*) also secured a definite enrichment of long-life humus from a thirteen years' continuous experiment with peat manuring on a light soil. These two research workers also showed that dressings of lime brought about a rapid decrease in nutrient humus, whereas long-life humus was increased. This result seems to definitely answer the age-old question of whether lime has a tendency to preserve or to destroy humus.

Green manure crops are essentially a source of nutrient humus, and therefore it would be a mistake to expect from them much permanent humus enrichment. Quite apart from a nitrogen supply, and however valuable green manuring may naturally be for the generation of carbon dioxide for the nutrition of micro-organisms and the loosening of heavy soils, one must remember that such problems are solved to a large extent through the breakdown of root and stubble residues. At any rate, from the standpoint of enrichment of soils with maintenance humus, it would seem more advantageous to use green crops for feeding animals, because in their digestive tract the indigestible lignins and proteins are to a large extent converted to permanent humus (*18*) and in the form of feces can then be utilized as stable manures.

Stable manures, as currently produced,

(Continued on page 24)

South Atlantic States Ask for More Nitrogen

Problems of farmers in Virginia and the Carolinas in obtaining sufficient supplies of nitrogen for fertilizer this year were reviewed at a meeting of representatives of farm organizations, experiment stations and control officials with the fertilizer subcommittee of the House Agricultural Committee on May 11th.

The next day a subcommittee of the delegation consisting of D. S. Coltrane, Commissioner of Agriculture of North Carolina; B. D. Cleaninger, South Carolina control official and M. A. Hubbard, official of the Virginia Farm Bureau Federation again conferred with the committee, together with representatives of the Office of Domestic Commerce and the Department of Commerce.

The upshot of the two days of conferences was that a representative group of the delegation would confer immediately with various producers of synthetic nitrogen to see whether a larger percentage of nitrogen in the various solid forms can be diverted from other sections to the southeastern area. They are to report back to the House Committee as soon as possible.

During the meetings both the export and domestic nitrogen situation were outlined by representatives of the Department of Agriculture and the Department of Commerce. Wilson T. Hart, fertilizer priorities administrator of the Department of Commerce, pointed out that one of the main problems is the lack of authority to direct the distribution of anhydrous ammonia. If this authority was available, he said, more of the ammonia could be directed for conversion into solid nitrogen and in that way lessen the difficulties in preparing the export program for next year.

The present law authorizes the exercise of priorities by the government only over fer-

RADIO FARM DIRECTORS ENTERTAINED BY PLANT FOOD COUNCIL

During their annual Washington meeting nearly 100 members of the National Association of Radio Farm Directors were guests of the American Plant Food Council at a luncheon held at the Hotel Carlton on Tuesday April 27th. Shown above at the head table are, left to right: Ken Gapen, Chief, Radio Service, U. S. D. A.; Hal Totten, WGN, Chicago, Secretary of NARFD; Clifton A. Woodrum, President of the Council, who spoke to the group explaining the organization's aims and purposes; Charles A. (Chuck) Worcester, WMT, Cedar Rapids, Iowa, President of the NARFD; Keith Himebaugh, Chief, Office of Information, U. S. D. A. and Donald G. Lerch, Director of Agriculture ("Country Journal"), Columbia Broadcasting System, Washington, Chairman of the local arrangements committee

—Photograph courtesy of American Plant Food Council

tilizer materials. The department has recommended to Congress that the Second Decontrol Act be amended to include nitrogen compounds. A bill containing such a provision has already been introduced in the senate by Senator Charles Tobey, of New Hampshire. Another was introduced on May 10th (S. 2641) by Senator Wayne Morse, of Oregon.

The Tobey measure is the so-called Harriman bill that was sent up to Congress early this year by the Department of Commerce during consideration of the overall question of materials controls. It has never advanced beyond the introduction stage. The Morse proposal is more directly concerned with the fertilizer problem and would amend the list of materials over which priorities can be exercised in the Second Decontrol Act for the purpose of "including nitrogenous compound, in any form, necessary for the manufacture and delivery of the nitrogenous fertilizer materials required for such export."

Mr. Hart, in his discussions with the committee, gave no definite figures on the amount of fertilizer nitrogen that would be produced through the exercise of the authority, if granted, but it was estimated that about 15,000 to 20,000 tons might be secured by converting anhydrous ammonia into solids, thus reducing the amount required from present sources to make up the estimated 61,000 tons for export for the 1948–49 season.

Mr. Coltrane told the committee that the North Carolina farmers were not getting their proportionate share of solid nitrogen, but he had no complaint at the present time with reference to the availability of mixed fertilizers.

Representative Anton Johnson of Illinois, chairman of the fertilizer subcommittee, said after the sessions that no immediate legislative action is contemplated, and that his committee would await the report of the delegation on their conversations with the producers before deciding what, if anything, can be done.

It is to be noted that any amendment to the Second Decontrol Act along the lines suggested would be a matter of direct consideration by the house banking and currency committee rather than the house agricultural committee, since the banking committee has jurisdiction over the Second Decontrol Act and any amendatory legislation.

Support the U. S. Security Bond Drive

House Committee Reports on Fertilizer Situation

In a report on the 1948 fertilizer situation, based on the hearings held last December, and made public on May 11th, the House Committee on Agriculture summed up the outlook for this year roughly as follows:—

1. Civilian production of basic fertilizer materials will be a little larger than last year.
2. Exports from civilian production will be a little smaller than last year.
3. Transportation difficulties will be less severe than during the last planting season and—in the absence of strikes or other unpredictable delays—prompt distribution of available fertilizer supplies should be considerably better than last year.
4. In spite of these favorable factors, the demand of American farmers for fertilizer is expected to exceed supply by 10 to 20 percent so that there will be many farmers who will not be able to obtain all the fertilizer they want.
5. The worst shortage will be in solid nitrogen material for top dressing and this will fall most heavily on sections of the southeast where this type of fertilizer is widely used.

The report also discussed the Army ordnance fertilizer program in relation to domestic supplies, and needs, and urged that any supplies above the needs of the occupied areas that might be available from these plants be shipped to other areas abroad. The report noted that there is authority for such exports in the letter authorizing operation of the plants for program in the occupied areas. The report said:—

"While the primary purpose of the Army fertilizer program is to provide nitrogenous fertilizer for occupied areas, there appears to be no reason why, if the output is sufficient, part of the material cannot be used for the general export and European recovery program in place of that which is now coming from commercial production. Such a purpose appears, in fact, to have been contemplated at the time the ordnance plants were put back into operation. The letter authorizing the Army to resume production of nitrogen says:

" 'It is further understood that while present plans contemplate that all fertilizer produced by the War Department under the plan approved above will be for the War Department's use under its allocation, it may, at a later date, be necessary to channel some of this production to other urgent purposes. In such an event, suitable financial and other arrangements will be made to accomplish such change.' "

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Program for Annual Convention of American Plant Food Council

Nationally-known agricultural editors, soil scientists, educators and Members of Congress will participate on the program for the Third Annual Convention of the American Plant Food Council at "The Greenbrier," White Sulphur Springs, West Virginia, June 13th to 16th, Clifton A. Woodrum, President of the Council, has announced.

More than 400 members of the fertilizer industry and their guests are expected to attend the sessions which will be highlighted with an address by Dr. Francis P. Gaines, President of Washington and Lee University, at the annual banquet on Tuesday evening, June 15th. The title of Dr. Gaines' address will be, "The First and Final Frontier."

Dr. Gaines is a nationally-known author and educator and is a former president of Wake Forest (N. C.) College. He was president of the Cooperative Education Association of Virginia, 1932–33; chairman of the Federal Emergency Relief Administration for Virginia, 1933–34; trustee, Carnegie Endowment for International Peace; member Board of Visitors, U. S. Naval Academy, 1935–36; president Southern University Conference, 1939–40; chairman, Virginia War Finance Committee during World War II; chairman, Virginia State Planning Board since 1942; vice-president, Association American Colleges, 1942–43; member, National Patent Planning Board, 1941–45; president, Association American Colleges, 1944–45.

Addresses by United States Senator Scott W. Lucas (D. Ill.), Member of the Senate Agriculture Committee and Dr. Robert E. Yoder, Agronomy Department, Agriculture Experiment Station, Wooster, Ohio, will be the principal speakers on the morning session of the Convention on Monday, June 14th, followed in the evening by the showing of the Council's new 16 mm. sound motion picture "First in the Hearts of Farmers" which has been widely acclaimed by agricultural leaders and farm organizations throughout the United States. A brief business session will be held prior to the morning addresses.

Continuing an annual feature of the Convention, the program on Tuesday, June 15th will begin with an Agricultural Editors' Forum on "The Farmer and Private Enterprise," with Dr. Paul D. Sanders, president of the American Agricultural Editors' Association and editor of *The Southern Planter*, Richmond, Virginia as moderator. Other participants on the Forum will include

Carroll P. Streeter, Managing Editor of the *Farm Journal*, Philadelphia; Dr. L. R. Neel, editor of the *Southern Agriculturist*, Nashville; and Paul C. Johnson, editor of the *Prairie Farmer*, Chicago.

Following the breakfast the Convention will hear addresses by Dr. Frank W. Parker, Assistant Chief of Bureau, Soils Division, Bureau of Plant Industry. Soils and Agricultural Engineering, U. S. D. A., Beltsville, Maryland and Representative August H. Andresen (R. Minn.) a member of the House Agriculture Committee. These will be followed by a business session at which eight members to the Board of Directors of the Council will be elected and resolutions will be adopted. Dr. Gaines will speak at the banquet session in the evening.

The Convention will be concluded on Wednesday, June 16 with a meeting of the new Board of Directors at which Mr. Woodrum will preside.

One of the outstanding features of the Convention will be a Golf Tournament with attractive trophies being awarded to winners in their various classes. The Golf Committee headed by A. B. Baker, Jr. of New York City, includes: A. B. Baker, Sr., of New York City; C. F. Burroughs, Jr. of Norfolk, Virginia; J. D. Stewart, Jr., Louisville, Kentucky; and J. A. Woods, Jr. of Tampa, Florida.

Lion Oil to Spend $3,500,000 Expanding Chemical Facilities

According to announcement by Board Chairman T. H. Barton, Lion Oil Company will expand its chemical plant facilities at El Dorado, Arkansas with a project estimated to cost $3,500,000. The new construction, to be tied in with the present operations, will increase the anhydrous ammonia capacity of the Chemical Plant from about 430 tons to 570 tons per day, an increase of 32.6 per cent. Col. Barton stated that the new project also provides for the construction of some 4,000 tons of pressure storage for ammonia necessitated by the increased volume to be handled. Plant enlargement is to be designed and supervised by Chemical Construction Corporation of New York, the same company having acted as architect-engineers and having supervised construction and initial operation of the present ammonia plant. Engineering work is now in progress and actual construction is expected to start in June, 1948, with completion of the entire project scheduled for the spring of 1949.

Col. Barton declared "Lion Oil's chemical plant has been producing over 125,000 tons of synthetic nitrogen per year, an appreciable percentage of the nation's total production. An acute domestic and, in fact, worldwide shortage of nitrogen has prevailed for the past several years and is expected to continue. Nitrogen, as a basic ingredient for fertilizers, is vitally needed to bolster the world's food production. This increase in the capacity of the chemical plant will, when completed, furnish an additional 50,000 tons annually of ammonia having a nitrogen content of approximately 83 per cent. It will represent a major contribution to the supply of a material in critically short supply. It is hoped that much of this increase in ammonia production can be made available to farmers in this country in areas where nitrogen is badly needed.

Thurston Chemical Opens Oklahoma Plant

The Thurston Chemical Co. played host to approximately 250 agriculture leaders, educators and industrialists when they formally opened Oklahoma's first fertilizer plant in Tulsa, on April 29th.

Geared to turn out 100,000 tons of superphosphates and regular analysis mixed fertilizers each year, the new plant is one of the largest of its type in the nation and is capable of supplying the "normal demand" in the Oklahoma, southern Kansas and northwest Arkansas area, according to W. R. Thurston, Joplin, Mo., president of the new firm.

Among the agriculture experts attending the opening was Dr. Henry G. Bennett, president of Oklahoma A & M College, Stillwater, who pointed out the critical loss of soil in the past four decades compared to the population increases. Also present at the opening were Col. Francis Wilson director of the Noble Foundation, Ardmore; Dr. Horace J. Harper, Chief Soil Scientist, Oklahoma A & M College; and Shawnee Brown, Director of Extension, Oklahoma A & M College, who hailed the new firm as an answer to a definite need to depleted soils in this area.

Although full production has not yet been reached, from six to eight carloads of fertilizer are being shipped each day to meet the demands in Oklahoma. Sales of "Bem Brand" will be handled through dealers in carload lots or as picked up at the Tulsa plant.

W. R. Thurston was formerly connected with the A. F. Pringle Co. in Charleston, South Carolina.

Resignation of Lockwood and Baylor Rumored

With the close of the current fertilizer year approaching, the rumor market has been busy regarding changes in executives in some of the leading fertilizer companies. The most interesting of those is that Maurice H. Lockwood, who has filled the office of President of the National Fertilizer Association so acceptably during the post-war years, will not be available for re-election for the coming Association year beginning July 1st, but will on that date join the executive staff of the International Minerals & Chemical Corporation, whose home offices are in Chicago. The same "grapevine" report is that H. B. Baylor, vice-president of International, will resign at that time.

Before assuming the presidency of the N. F. A., Mr. Lockwood had for many years headed the fertilizer department of Eastern States Farmers Exchange, West Springfield, Mass. and had served as Chairman of the N. F. A. Board of Directors.

Spencer Chemical Buys Jayhawk Ordnance Works

The War Assets Administration on May 12th approved sale of the surplus Jayhawk Ordnance Works, Galena, Kans., to the Spencer Chemical Company, Kansas City, Mo., for $11,000,000.

It was constructed during the war for the production of anhydrous ammonia, nitric acid and water solution of ammonium nitrate used in manufacturing explosives. Later, facilities were added to permit manufacture of additional nitric acid, agriculture fertilizer solution, aqua ammonia, methanol and dry ice.

A condition of the sale, under the National Security Clause, is that the present potential capacity of the plant for production of anhydrous ammonia will be maintained.

Chase Bag Acquires California Plant

Another important step in Chase Bag Company's expansion program has been taken through the recent acquisition of a modern California bag factory and all its manufacturing facilities. The announcement was made from the Chase Executive Office in New York by Mr. F. H. Ludington, President, who said the new Los Angeles plant, formerly operated by Southern California Bag Company, brings the total number of Chase manufacturing branches to fifteen.

The increased milling activity in the territory served by Los Angeles, as well as the growing demand for Saxolin open mesh bags for citrus and other west coast produce, prompted the factory acquisition which will enable Chase to fulfill more completely the needs of their west coast customers.

The transaction with Chase was made by William Tannenbaum, President and General Manager of the well established Southern California Bag Company, which enjoyed many years of success in manufacturing new burlap and cotton bags, processing and merchandising second hand textile bags.

Chase Bag Co. Plant at Los Angeles, Cal.

R. R. Koch, who for ten years has served as Sales Manager of the Chase Bag Company's Portland, Oregon Branch, has been named Manager of the new Los Angeles factory.

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FERTILIZER MATERIALS MARKET

NEW YORK

Sulphate of Ammonia Still Behind on Shipments. Strike Cuts Production of Nitrogen Solutions. More Interest Shown in Fertilizer Organics. Potash Prices Show Little Change for Next Year. Better Demand for Superphosphate Reported

Exclusive Correspondence to "The American Fertilizer"

NEW YORK, May 12, 1948.

Sulphate of Ammonia

This material was still in short supply as producers were still feeling the effects of the recent coal strike. While shipments were going forward at a slightly better rate, most producers were still considerably behind on shipments.

Nitrate of Soda

Importers are trying to maintain their original shipping schedules but the demand is stilll heavy from various sections, particularly for top-dressing material.

Ammonium Nitrate

Very little of this material is reported moving in the North although buyers would be glad to receive anything they could get. Exports under allocation are still getting a large share of the production.

Nitrogen Solutions

One large plant was on strike, which further cut down the available supply of this material. Manufacturers were seeking supplies in various directions but about everything has been sold ahead on contract.

Organics

Buyers continued to manifest interest in future positions for organic fertilizer materials at present low prices and some buying was reported of material for nearby shipment for future use. The feed trade were still not active in vegetable meals but prices did not decline any further and seem to be stabilized around present levels. Tankage and blood were quoted at around $6.00 per unit of ammonia ($7.29 per unit N), and some sales were reported at even lower levels but due to the continuance of the meat packing strike production is off at certain sections of the country.

Fish Meal

Further sales were reported of the unground fish scrap on a "when and if made basis" at $110.00 per ton, f.o.b. fish factories. Buying, however, was not aggressive. Several lots of imported fish meal arrived at various ports. The feed market was only showing slight interest at present prices.

Castor Pomace

Producers withdrew offerings of this material at $27.50 per ton because of a sold-up position. Increased demand was in evidence from various sections at the current market price but buyers who bought early made sure they obtained what they wanted.

Nitrogenous Tankage

Buyers have picked up a considerable quantity of this material recently at the reduced prices, and some producers do not seem very anxious to take on any more business as they seem to feel the prices are too low.

Garbage Tankage

Very few trades were reported in this material but the demand is fairly good from most sections.

Superphosphate

Some export inquiry was noted for this material and the demand has increased from the domestic trade due to better weather conditions. Prices are holding about the same, with no price cutting reported.

Potash

All domestic producers have announced their new prices for the coming season with only slight price change. Sulphate of potash was advanced slightly in price. Several cargoes of Russian potash were reported to have arrived at American ports recently.

CHICAGO

Market on Feed and Fertilizer Organics Dull. Prices Drop and Fertilizer Declines Expected

Exclusive Correspondence to "The American Fertilizer"

CHICAGO, May 10, 1948.

The dullness in the animal ammoniates market during the past two to three weeks has been reflected in the decline of prices. Even at the lower levels, trading is only on a meager scale and buyers are showing interest only in either immediate requirements or for replacement.

Present indications are that prices have not yet reached a low enough basis for buyers to risk building up a backlog of unfinished materials and until this happens or there is some other development which would stimulate trading, it appears that further declines may be anticipated.

Dried blood and wet rendered tankage last sold at $6.00 per unit of ammonia ($7.29 per unit N), and dry rendered tankage is down to $1.25 per unit of protein. Steamed bone meal is still quoted nominally at $60.00 per ton but it would probably take a lower price than this to induce buyers to show any interest.

PHILADELPHIA

Shortage of Materials Still Critical. Lower Prices Reported for Organic Materials. Increase in Sulphate of Potash Price Reported

Exclusive Correspondence to "The American Fertilizer"

PHILADELPHIA, May 10, 1948.

The slack supply of some of the raw fertilizer materials still continues to be a serious problem. It is reported that some manufacturers are omitting nitrogen from some of their mixtures. Most forms of organic nitrogen are lower in price and in better supply. Phosphate rock prices are higher at the mines.

Sulphate of Ammonia.—Shipments continue behind schedule and demand is much in excess of supply. Any available resale material commands premium prices.

Nitrate of Soda.—Requirements are much beyond any hope of satisfaction, and the market is definitely tight. Imports continue to arrive on schedule but the supply is entirely inadequate.

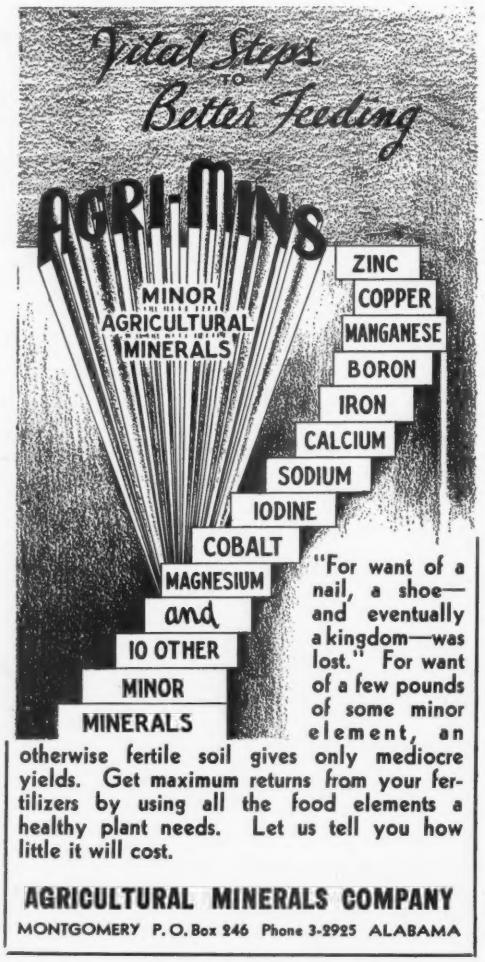
Ammonium Nitrate.—Market is in very tight position and the supply is hopelessly inadequate.

Castor Pomace.—Sales were reported at $27.50 per ton, f.o.b. producing plants, but present market is said to be stronger and higher quotations are expected.

Blood, Tankage, Bone.—Published quotations are now admittedly lower—at from $6.00 per unit of ammonia ($7.29 per unit N) for tankage to $6.50 ($7.90 per unit N) for blood, but there have been sales below these figures. The demand from both the feeding and fertilizer trades has improved. Bone meal is in greater demand than supply and no free offerings have been reported.

Fish Scrap.—Some business has been transacted on a "when and if made" basis at $125.00 to $130.00 per ton for 60 per cent to 65 per cent protein meal, with scrap at about $110.00. Present fishing operations are said to be not very favorable.

Phosphate Rock.—While prices have been advanced slightly, the demand still runs ahead of production and the market is tight.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Superphosphate.—Conditions are reported more nearly normal, with deliveries moving out rather freely. Price is indicated as 76 cents per unit Available Phosphoric Acid, Baltimore area.

Potash.—While muriate and manure salts remain at same price as last season, sulphate is reported to have been advanced $2.50 per ton. The demand seems to keep ahead of production. Baltimore reports a recent arrival from Russia.

CHARLESTON

Organics Market Weakens. Heavy Demand for All Chemical Materials with Supply Short. Imports of Russian Potash Reported

Exclusive Correspondence to "The American Fertilizer"

CHARLESTON, May 10, 1948.

Some sales of organics have been made at considerably reduced prices compared with the previous season's prices. Superphosphate is slightly easier with the market firm. Potash demand continues strong for spot and contract shipment. Nitrogen is the main bottleneck, and its continued shortage is of prime concern to all manufacturers.

Organics.—Some organics are relatively weak, whereas others have stabilized in price, due to greater interest on the part of feed and fertilizer buyers. Domestic nitrogenous tankage continues at $3.25 to $4.00 per unit of ammonia ($3.95 to $4.86 per unit N) in bulk, f.o.b. production points, depending on the location of the producer. South American organics are still above parity of the domestic market.

Castor Pomace.—Considerable business has been done recently at $27.50 per ton in bags, f.o.b. works in the east, for prompt shipment, with some shipments during the summer.

Potash.—The supplies of spot material have shown no improvement, and demand continues active with interest in contract renewals exceedingly strong. Some Russian potash has arrived recently.

Nitrate of Soda.—According to present prospects it appears that the entire allocation for this season will arrive in time to be used to best advantage. Imports in January were substantially above previous months. During the first seven months of the 1947–1948 season 268,050 tons were imported, but demand continues heavier than supply.

Sulphate of Ammonia.—Shipments continue behind schedule with demand still very active. Market remains tight and is expected to be tight for an indefinite period.

Dried Ground Blood.—Blood is quoted at $6.00 to $6.25 per unit of ammonia ($7.29 to $7.59 per unit N) in bulk, f.o.b. Chicago, and around $6.00 per unit ($7.29 per unit N) in

Tankage.—Wet rendered tankage is around $6.00 per unit of ammonia ($7.29 per unit N), f.o.b. production in the New York area, with prices approximately the same in the Chicago area.

Superphosphate.—Due to the strong market situation on phosphate rock, superphosphate correspondingly continues firm in price, though supplies are slightly easier than in previous months.

Phosphate Rock.—The market position is firm in spite of the recent advance in price. Demand continues sufficiently strong to keep stocks above ground at low levels.

March Sulphate of Ammonia

The coal strike did not make any appreciable impression on the production of by product sulphate of ammonia during March, according to the figures of the U. S. Bureau of Mines. Production from coke-oven ammonia totaled 68,758 tons, an increase of two per cent over the shorter month of February. In addition,

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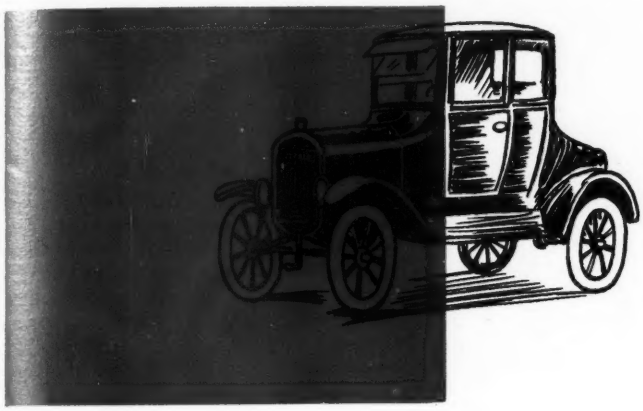

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2,296 tons were produced from purchased synthetic ammonia. Shipments during March increased 19 per cent, to 79,098 tons, which left only 21,098 tons in the producers' stock piles at the end of the month. This is the smallest reserve supply for a great many months.

	By-Product Sulphate of Ammonia	Ammonia Product Ammonia Liquor
Production	Tons	Tons NH_3
March, 1948	68,758	2,090
February, 1948	67,416	1,990
March, 1947	67,677	2,266
Jan.-March, 1948	208,049	6,174
Jan.-March, 1947	197,020	6,415
Shipments		
March, 1948	79,098	2,139
February, 1948	66,373	1,988
March, 1947	74,577	2,080
Stocks on Hand		
March 31, 1948	21,098	721
February 29, 1948	31,988	926
March 31, 1947	32,719	885

Congress Urged to Divert Ammonia to Sulphate Production

Support is growing in Congress for giving the Administration authority to channel anhydrous ammonia to idle West Coast and Southern fertilizer plants according to an item in the *New York Journal of Commerce.*

The Administration plan, already approved in principle by the Commerce Department's Fertilizer Industry Advisory Committee, is regarded as a boon to farmers in the Southeast and West Coast by Congressmen from those areas.

If granted the authority, the department would use priority ratings to take a certain percentage of the 475,000 tons of anhydrous ammonia expected to be produced this year and channel it to producers of synthetic ammonium sulphate.

Production of ammonium sulphate fertilizer resulting from this movement would be exported as part of the 60,000 tons of nitrogen commercial that producers probably will be required to export in the coming fertilizer year.

However, with synthetic ammonium sulphate supplying a greater share of the export requirement, coke-oven by-product ammonium sulphate and other nitrogenous fertilizer production will be that much more available to domestic agriculture.

That's what appeals to Southern farmers, hard-pressed for nitrogenous fertilizers. West Coast Congressmen have been active here for several months in appealing for anhydrous ammonia so synthetic ammonium sulphate plants in Oregon, Washington and California can carry on.

Representative Walter Norblad (Rep., Ore.) has introduced legislation (HR 6508) amending the law granting OMD authority to use priorities assistance to get nitrogen fertilizer overseas. The amendment would extend this authority to "nitrogenous compounds in any form necessary for the manufacture and delivery of nitrogenous fertilizer material required for export."

The American Coke and Coal Chemicals Institute, representing merchant coke producers who make anhydrous ammonia from coal, has sent letters to each member of the House Banking Committee urging the amendment. This committee is slated to act on requested extension of authority to use priorities for the nitrogenous fertilizer export program. Existing authority expires May 31.

If the authority is granted, OMD will call in its industry advisers to help set the per-

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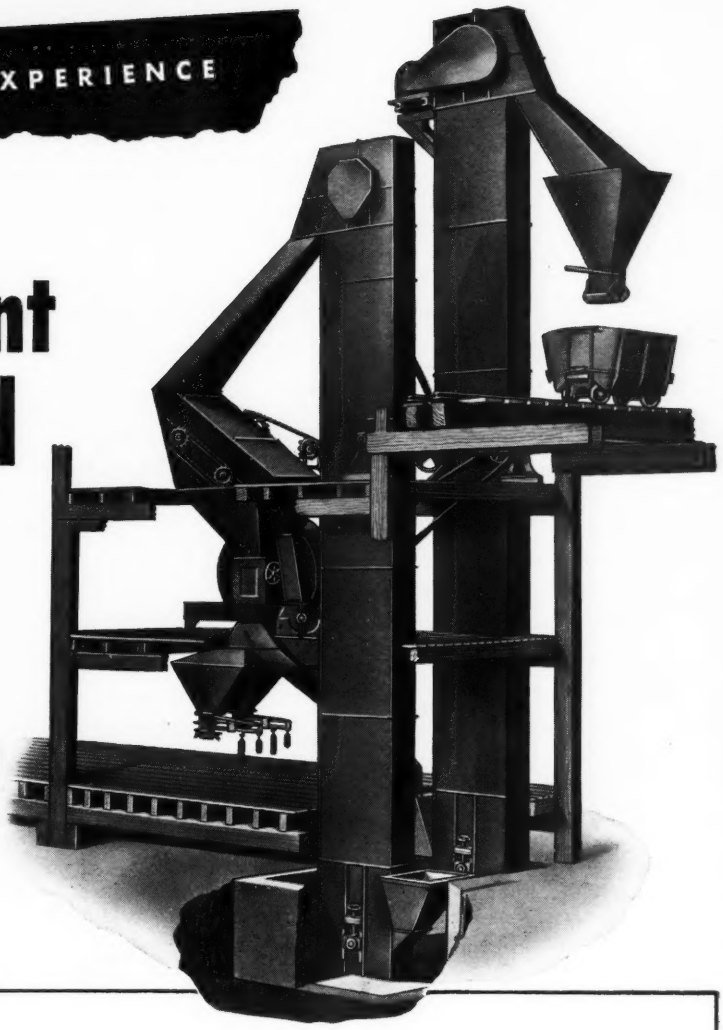

The Sturtevant Mill Company has designed, equipment-engineered and supervised construction of numerous fertilizer plants both at home and abroad. This organization is staffed by experts with cumulative practical experience of over 55 years in the design, manufacture, erection and operation of fertilizer plants and equipment. Its engineers have the technical knowledge and know-how to design, construct and equip a practical and economical plant that pays off in production and profit.

Although much of the equipment recommended is Sturtevant Mill Company Fertilizer Equipment, Sturtevant Engineers *always* specify and recommend other makers' products wherever this equipment best fits into the overall production picture. One important item to bear in mind—Sturtevant Engineers first diagnose the problem from the information supplied by the client. It means that the client knows his project before committing himself to anything.

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centage of anhydrous ammonia to be channeled to synthetic ammonium sulphate production. The percentage is likely to be fixed at about three to five per cent of total ammonia output.

Most of this "diversion" will come from industrial rather than agricultural users. Industry is using some 363,000 tons of anhydrous ammonia this year, while 112,000 tons are going to agricultural use for direct application to the land or mixture in other fertilizer materials.

Assuming some 20,000 tons of anhydrous ammonia is channeled into synthetic ammonium sulphate, it would be reflected in production of processing as about 80,000 tons of synthetic ammonium sulphate fertilizer.

Report on German Cyanamide Process

The fixation of atmospheric nitrogen into cyanamide by reacting calcium carbide with nitrogen was a large industry in wartime Germany according to a report on German carbide and cyanamide production now on sale by the Office of Technical Services, Department of Commerce. The report was prepared by investigators for the British Intelligence Objectives Sub-Committee.

In all cases, the report states, the German manufacturers first isolated the nitrogen in an air separation plant and then reacted the nitrogen with the carbide according to the formula:

$$CaC_2 + N_2 = CaCN_2 + C$$

(calcium carbide + nitrogen = calcium cyanamide + carbon)

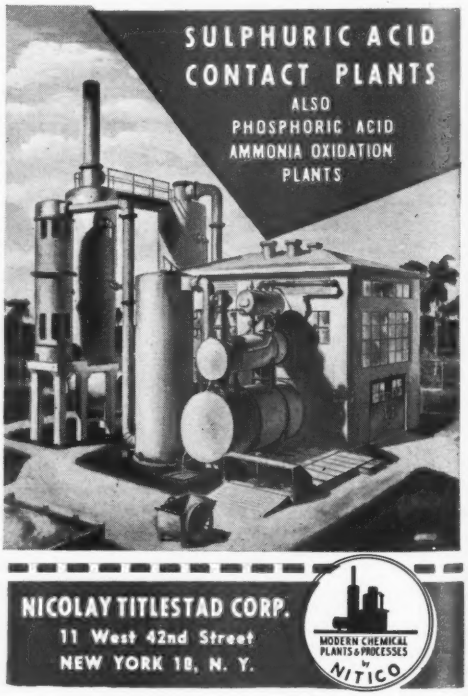
Three different types of apparatus were used.

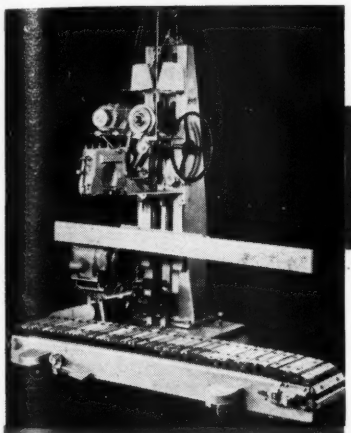
The firm Suddeutsche Kalkstickstoff at Trostberg carried out the operation in vertical refractory lined units in two buildings. One contained 720 one-ton capacity converters; the other contained 105 eight-ton capacity and 105 six-ton capacity converters. The output of both buildings was about the same. Maximum annual production for the plant was somewhat more than 50,000 tons of nitrogen. More labor was required for the one-ton converters but they also yielded a product with higher nitrogen content, according to the report.

The firm Lonza Werke at Waldshut used a tunnel kiln process. The installation consisted of seven tunnels 1.8 m. high and 2 m. wide (internal measurement) constructed of refractory brick work 500 mm. thick. Counterweighted vertical lifting doors at each end of the tunnels were sealed when shut by dipping the bottoms into a trough of oil and by clamps which pressed the doors against a joint ring on the end of the tunnels. This prevented leakage of nitrogen. The daily output of the plant was said to be 130 tons of 22 per cent cyanamide.

At the A. F. Fuer Stickstoffdunger firm at Knapsack, five rotary kilns had been installed in 1936 and had operated satisfactorily ever since. The rotary kiln was made of normal carbon steel and comprised a horizontal steel cylinder with dished ends. The cylinder had a 3-meter internal diameter and was 12 mm. long. It was lined with refractory brick 200 mm. thick. Fifty-six cooling fins surrounded the outside of the drum. The kiln had a one per cent slope towards the exit end. There were no mechanical aids to assist in the forward travel of the material. The kiln was rotated at 2.65 r.p.m. The maximum output was 250 tons a day. The conversion on carbide was about 91 per cent and nitrogen fixation efficiency, 66 per cent.

Diagrams of the equipment and a discussion of equipment operation are contained in the report (PB-80371, *German carbide and cyanamide industry, manufacture of calcium cyanamide*, 25 pages). The report sells for 75 cents.





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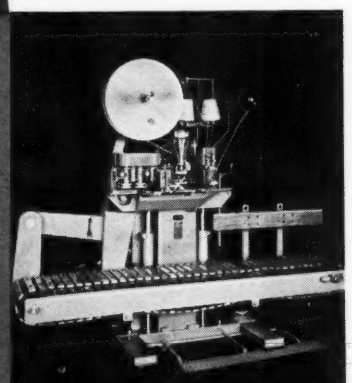
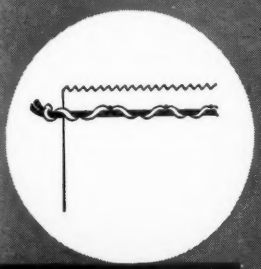


MODEL "DA" (portable) applies taped "cushion-stitch" closure. One operator, filling and closing, can handle 2 to 4 bags a minute . . . 6 to 12 where filled bags are delivered to BAGPAKER conveyor. Sewing operation starts and stops automatically—no tape wasted.



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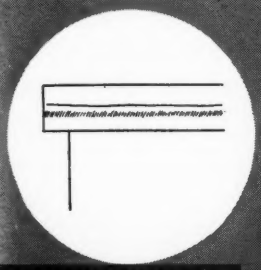

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NATURE AND PROBLEMS OF FERTILIZING IN MODERN TIMES

(Continued from page 9)

contain humin matter and putrefaction products to a large degree as humolignates, and ammonium humates in water soluble forms, which under superhumid conditions undergo heavy leaching. Furthermore, as shown by Siegel (*19*), free humic acids are subject to leaching much more than combined humic acids, so that it is advisable to bind humin substances to calcium and inorganic sorption complexes already in the manure pile, if possible.

L. Meyer (*20*) and also Siegel (*21*) obtained considerably higher yields of permanent humus by the addition of a minimum of two per cent montmorillonite during the decomposition of stable manure. The ideal goal, however, would be as already mentioned, to compost stable manure. By so doing the formation of clay humus complexes would be transferred to the composting pile. The introduction of a composting machine by Kertschner (*22*) has, without doubt, advanced the practical realization of manufacturing this earth-manure. Naturally there are still many questions to be solved in the field of composting in general, and in the composting of stable manure in particular; especially because the investigations of Springer (*14*) have shown that good composts may show a very high degree of decomposition and also a much more favorable color than manure piles and heated manures, but at the same time show no gray humic acids. Results so far obtained confirm the fact that even in composts we do not obtain qualities equal to black earth humus, so that one of the research questions is to ascertain the manner in which gray humic acids originate. Not until we know how they are generated will it be possible in the future to direct the process of composting so as to produce a maximum of gray humic acids.

Evaluating Humus Manures

The many methods which have been worked out to characterize any one of our presently known forms of humus and for the determination of the degree of disintegration, have led not only to valuable insight into the process of decomposition in the production of artificial fertilizer materials, but also have made possible the evaluation of humus manures foreign to our domestic economy.

These commercial humus manures must be judged today not alone from the standpoint of nutrient content, but more and more a measure of their value is the degree of their decomposition and the kind of their humus content. Also with reference to their dung water and liquid manure, emphasis must in future also be placed more upon the production of high quality humin substances, than merely the retention of nutrients. This observation brings to mind the experiments which have been made with peat-urine composts (*23*). Further problems are presented by the rational utilization of sewage—wet and dry sludge—in connection with which should be mentioned the attempt to produce a mineral-peat compost (*24*) as well as the modern production of manure additives and especially straw composts.

Important also from a humus production viewpoint is the utilization of the enormous quantities of lignin, obtained in the production of cellulose in the form of lignosulphonic acids in sulphite liquors; and as straight lignin, a by-product in the manufacture of sugar from wood, according to the processes of Bergius and Scholler. In this connection, investigations should be made as to whether it would be worthwhile to bind cationic nutrients to lignin for the purpose of removing undesirable anions (*25*).

Even though, as previously shown, the usual barnyard manures are in the forefront as a means of enriching the soil with humus materials, and even though we question the manure supplements used for rounding out their value and also the fertilizers foreign to our domestic economy, yet it should nevertheless NOT be forgotten that in a real measure the mineral fertilizers do have a part,

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even though indirectly, in securing humus in the soil. Increased mineral fertilization produces higher yields and through such we get better fodder, which leads to the production of higher quantities of barnyard manure, and more stubble and root residues,—all of which in turn make for an increase in nutrient humus. Schmitt (*26*) has particularly shown to what a considerable size stable manure production developed in Germany since the introduction of commercial fertilizers, which began about 1850, and K. Schmalfuss (*27*) proved that, by means of combined nitrogen-mineral fertilization, the persistent as well as the nutrient type of humus was increased.

Calcium Fertilization

A well controlled calcium fertilization is a decisive factor in the maintenance of soil fertility. Calcium not only neutralizes hydrogen ions present in soils, but di-valent calcium ions, according to the research of Schulze-Hardy (*28*), cause flocculation of soil colloids which are mainly negatively charged, and these, through the building of calcium-acidoids, create one of the most important prerequisites to a correct granulation of soils. By these reactions excessive calcium ions remaining in soil solutions simultaneously furnish a certain guaranty for their long-time persistence in a gel condition.

In this manner the condition of soil mellowness is essentially brought about which, as already mentioned, was aptly defined by Seckera (*13*) as consisting chiefly of a crumb structure. V. Nitzsch (*29*) showed that not only cations but also anions influence soil granulation. For instance, it was shown that the bicarbonate and phosphate ions behave in a favorable, and the chloride ions in an unfavorable, manner. From this standpoint the importance of the nutrient humus and good soil respiration is again accentuated, which is tantamount to the value of a correct humus fertilization which must deliver sufficient quantities of carbon dioxide. Associated with calcium fertilization is the essential need that enough calcium and bicarbonate ions be produced in the soil solution.

Soil fertility, as well as the favorable effect of mineral fertilization upon crop yields (both influenced by soil reaction equilibria), show that the bringing about of correct soil reactions, specifically, optimal calcium conditions in soils, is one of the most important fertilizing measures that can be undertaken. The exchange capacity injurious to plants, associated with the appearance of the poisonous

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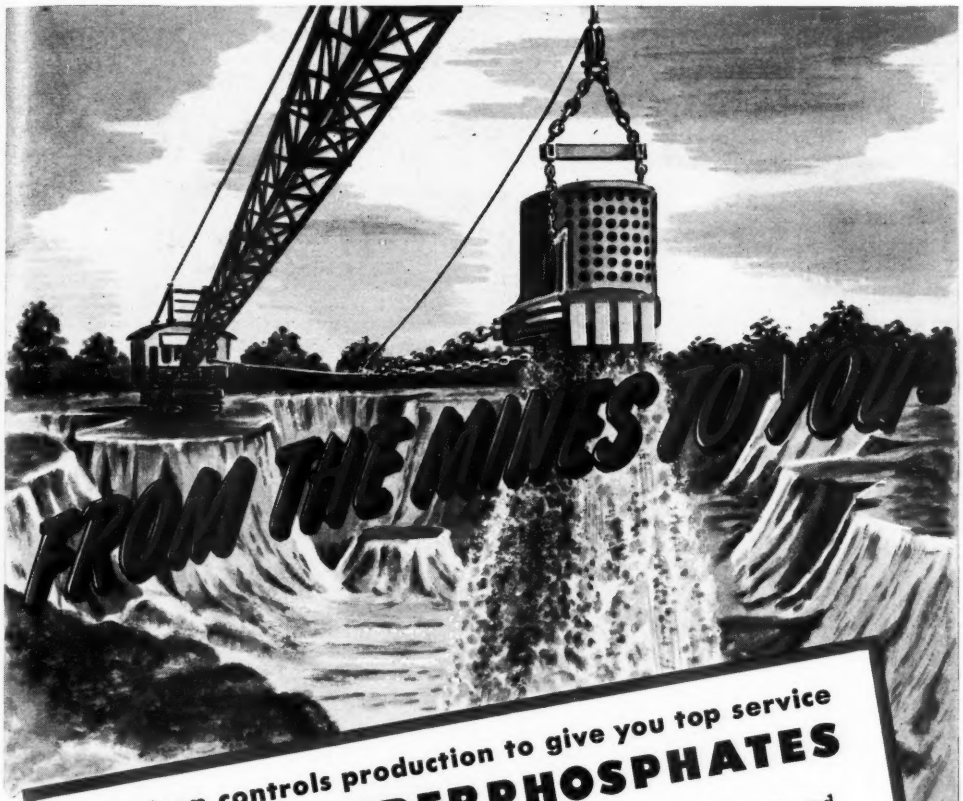

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aluminum ion, should in all cases be removed. Fertilization with a phosphoric acid fertilizer is of value to phosphorus-deficient soil only when there are no free aluminum and iron ions in soil solutions, because otherwise phosphoric acid will only be fixed in the forms of aluminum and iron phosphates. These compounds cannot be utilized by plants. Therefore, a phosphoric acid fertilization could only be effective at a soil *p*H of over 5.3. Our Ministry for Nutrition, immediately the present war broke out, promulgated a special soil investigation, whose duty was to ascertain the needs of phosphoric acid and calcium of all soils used for agricultural and gardening purposes.

The phosphoric acid requirements are determined by soil tests, of which the lactate method of Egner (*32*) is one, and the calcium conditions by the electrometric short titration method of Goy-Roos (*33*). According to Schachtschabel (*34*), the latter method needs improvement and he has substituted for it a more suitable method. A rational fertilization is only possible on the basis of exact knowledge about the fertilizer requirements of soils, and therefore it is absolutely necessary to possess methods which can in the quickest way furnish us a good picture of the nutrient requirements of soils and their reaction potentials. A complete insight into the calcium position of soils is only secured when we know definitely not only its actual (*p*H) number potential acidity, but also its buffering capacity.

Controlled calcium conditions of soils are, however, not only of fundamental importance in fertilizing with phosphorus but, according to the potash-calcium law of Ebrenburg (*35*), an antagonism exists between potash and calcium, and the effect of calcium fertilization depends very largely upon the quantity of absorbed calcium ions in the soil in question. This is a recognition, which, in a purely empirical manner in practice, is expressed in the proverb that "calcium may produce rich fathers, but poor grandchildren."

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